ARL partners with MIT to develop soldier nanotechnologies

ARL and the Army Natick Soldier Center will work with MIT to equip future soldiers with uniforms and gear that can heal them, shield them and protect them against chemical and biological warfare.

MIT won the Army competition for the five-year, $50 million proposal for an Institute for Soldier Nanotechnologies (ISN). Industry will also contribute an additional $40 million in funds and equipment. Raytheon, DuPont and Massachusetts General/ Brigham and Women's Hospital are Founding Industry Partners with the institute.

The ISN will focus on six key capabilities. They are threat detection, threat neutralization, concealment, enhanced human performance, real-time automated medical treatment, and reduced logistical footprints (reducing the weight load for a fully-equipped soldier).

To address these, there will be research teams addressing seven technology areas. They are energy absorbing materials, mechanical active materials for devices and exoskeltons, detection and signature management, biomaterials and nanodevices for soldier medical technology, process systems for manufacture and processing of materials, modeling and simulation, and systems integration.

In addition to military use, great potential is anticipated for civilian use in areas such as medical treatment, and police and emergency worker protection.

ARL's vision is a laboratory preeminent in key research areas of science and engineering relevant to land warfare; a staff widely recognized as outstanding; a partner within the defense community, close to Army users and seen by them as essential to their missions; an "intellectual crossroads" for the technical community, intensively interacting with academe, industry, and other government laboratories.

ARL is doubling computing capacity

ARL's high-performance computing capacity at Aberdeen Proving Ground, MD, will double as a result of a $14 million contract awarded to Raytheon Co. by the Defense Department's High Performance Computing Modernization Office.

Under the contract, Raytheon will install and test what will be the largest supercomputer at ARL, the company said. The supercomputer will consist of 800

1.3-GHz IBM Power4 processors and will operate three to four times faster than the two IBM Power3 systems it will supersede.

The new system will double the overall computational capability of the laboratory's high-performance supercomputers to more than 7.1 trillion floating-point operations per second.

X-Ray imaging holds promise for humanitarian demining

Promising results from university research in X-ray imaging of buried landmines, developed under support from the Army Research Laboratory and the Army Communications and Electronics Command, is paving a path to a potential confirmation sensor for humanitarian demining.

The University of Florida experimental system uses the correlation of the collimated and uncollimated images to remove surface clutter — a process called Lateral Migration Radiography. The differences between the front and back collimated images provide information about depth. The X-ray system has the ability to image shape. Such shape and structure information is a powerful discriminant to eliminate false alarms, such as buried rocks or metallic debris. Because the X-ray backscatter technique images atomic density, rather than conductivity or dielectric contrast, it has the potential to be a potent complementary partner to traditional electromagnetic metal detectors or ground penatrating radar in a fused sensor architecture.

The current X-ray system requires from several to tens of seconds dwell time, and some additional processing time at each location, suiting it for a confirmation role. It is projected to have a capability to image buried mines up to four inches (top to surface) deep.

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New training methods increase mine detection results

Sometimes, the way you do something makes all the difference.

ARL working with Carnegie Mellon University has improved the probability of detection of land mines with low metal content using the Army's current hand-held mine detector by almost 80 percent.

Tests using the detector and soldiers employing standard Army detection techniques revealed that the typical detection rate was well below 20 percent. A detailed study was made of how expert humanitarian deminers use the same detectors to find nearly 100 percent of the same types of mines. A specific training regimen was developed to transfer the specific skills used by the experts to soldiers as was a training site that could efficiently enable soldiers to develop the required skills and could be practically constructed by field units.

Results with the new training program resulted in enormous increases in probability of detection in relatively little training time. Repeatedly, tests have shown increases in probability of detection from less than 20 percent using standard techniques to 75 percent (less than one hour of training) to 98 percent (about 15 hours of training) using the expert techniques. Detailed information on the training, specific plans for site development, and where to get the mine simulants is available.

Much of this research that has increased soldier performance with the current detector will also apply to the Handheld Standoff Mine Detector System now under development.

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Lab pioneers development of 3-D human figure modeling

Human factors has expanded from the design of the immediate human-to-machine displays and controls interface to all aspects of the interaction among technologies and individuals and groups.

But soldier and equipment mismatches in physical fit, reach, and vision can still be challenges.

With academic and other research and development partners, the Army Research Laboratory has pioneered the development and use of human figure modeling within a 3-D computer-aided design (CAD) environment to pinpoint physical fit, reach, and vision problems, often before any physical prototypes have been built.

For example, human figure modeling tools were used to examine the feasibility of transporting a nine-person infantry squad in candidate Interim Armored Vehicle (IAV) variants in support of the source selection process. ARL is currently using human figure modeling to look at C-130 transportability issues for

Human Figure Model representing C-130 Loadmaster Traversing Infantry Carrier Vehicle

the IAV variants, a key requirement for the program.

The modeling effort is specifically focused on the ability of the C-130 Loadmaster to traverse each vehicle when loaded inside the cargo area as well as investigate the maintainability of defined safety aisles.

As part of the overall test and evaluation, ARL will also be using human figure modeling to help perform Manpower and Personnel Integration assessments of the crew station areas and troop compartments for each IAV variant to identify potential accommodation issues.

Acoustic sensors may keep tabs on soldiers in battle

ARL is developing acoustic sensors that can be worn around the neck or wrist to help monitor soldiers' physiological condition on the battlefield.

The sensors pick up breathing patterns and heartbeat rates and transmit the readings through a wireless communications device to a remote receiver. The sensors use microphones inside pads filled with a gel with the density and sound speed match of human tissue. This optimizes conduction of sound from within the skin to the sensor while blocking out

ambient noise.

The sensor monitors heart and breath rates, blood pressure, coughing, vomiting and other symptoms of distress.

TechBriefs

Acoustic sensing systems detect targets and gather intelligence

ARL is developing acoustic sensing systems that will enable soldier or law enforcement agents to detect, monitor and localize sounds at increased distances. The systems could also restore hearing ability degraded by headgear.

Two prototypes have been developed. One is a rife-mounted acoustic array that provided long-range directional hearing capability for detecting acoustic targets and gathering intelligence. Under favorable conditions, conversations have been detected and understood at distances of up to 200 meters.

The second is an attachment to the soldier's headgear that restores listening abilities degraded by the headgear and offers enhanced capabilities, including hearing protection and in-the-ear communication. This system uses synthetic pinnas (outer ear structures) for omnidirectional sound localization.

Both prototypes are being evaluated for special operations forces and law enforcement applications, such as covert reconnaissance and target detection.

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